

Roll Tilt Self-Motion Direction Discrimination: First Evidence for Perceptual Learning

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Vestibular Oriented Research Meeting 2019

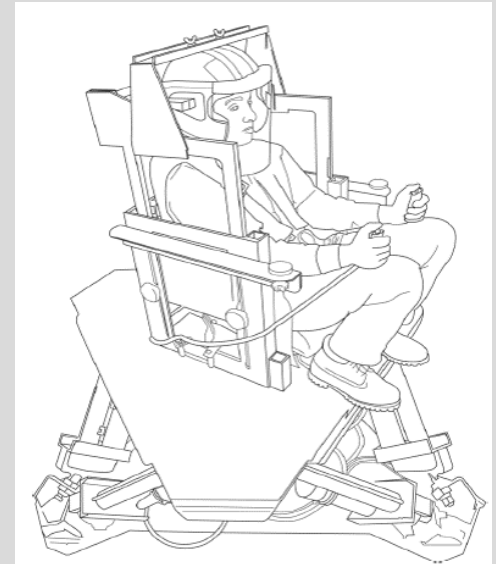
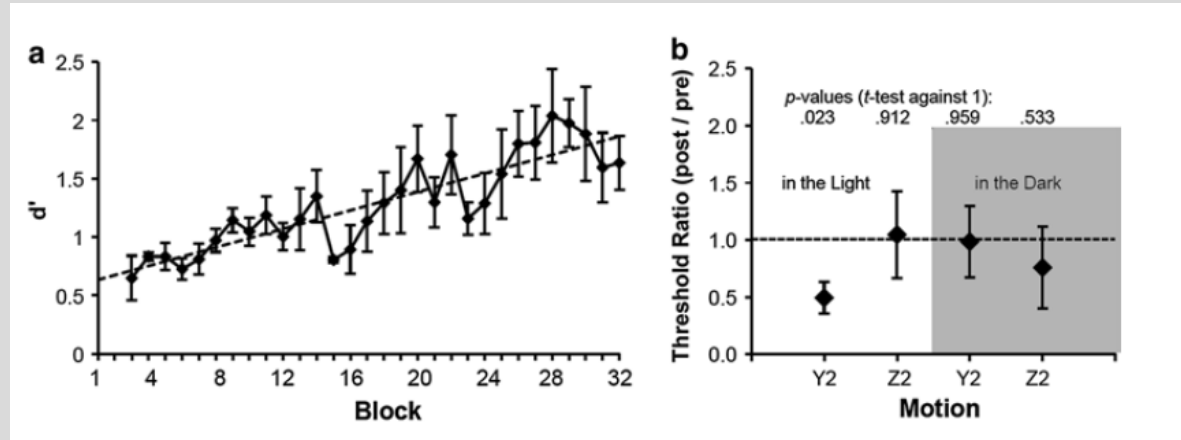
Research Question

Can vestibular self-motion perception thresholds be improved through practice?

Perceptual Learning

Self-Motion Perception Training (Hartmann et al., 2013)

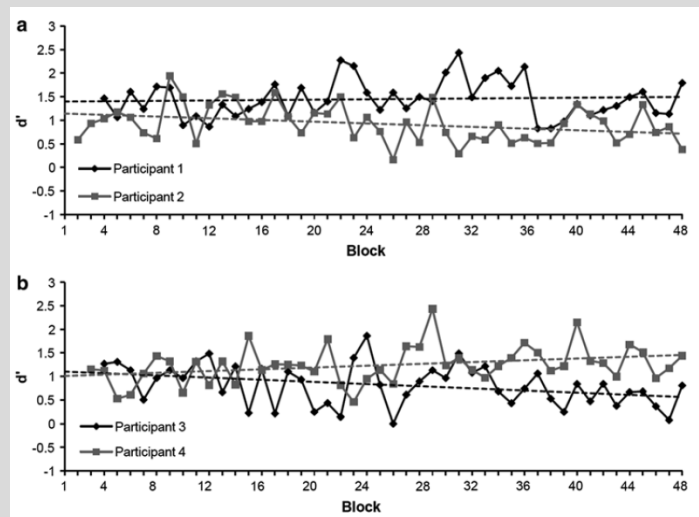
Y-Translation: In the light



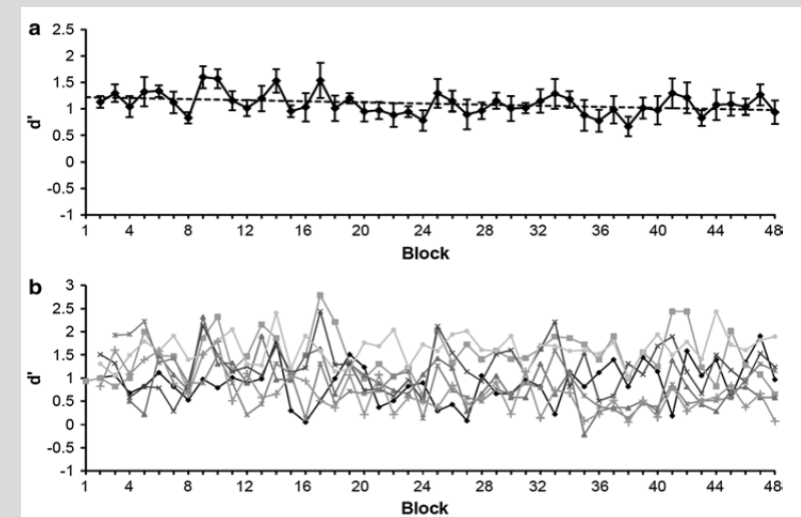
Perceptual Learning

Self-Motion Perception Training (Hartmann et al., 2013)

Yaw Rotation: In the dark



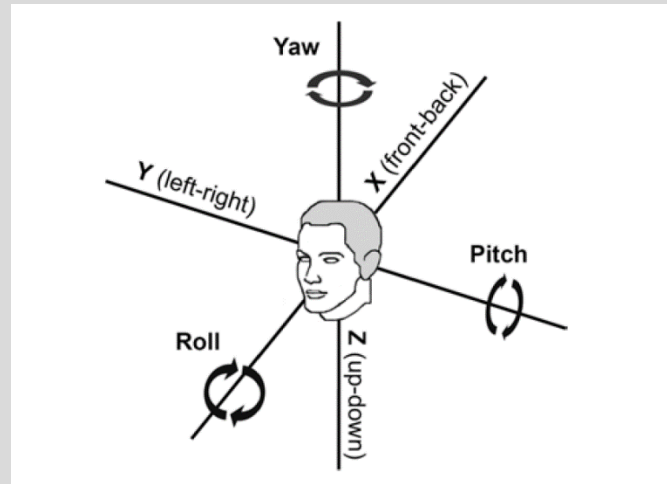
Y-Translation: In the dark



Perceptual Learning

0.2 Hz Roll Tilt Self-Motion Stimuli

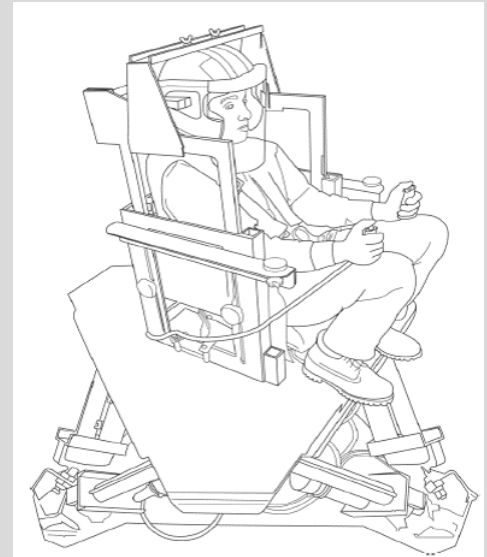
- Combined semicircular canal and otolith input
- 0.2 Hz Roll self-motion perception thresholds predict performance in balance tests (Karmali et al., 2017)



Methods

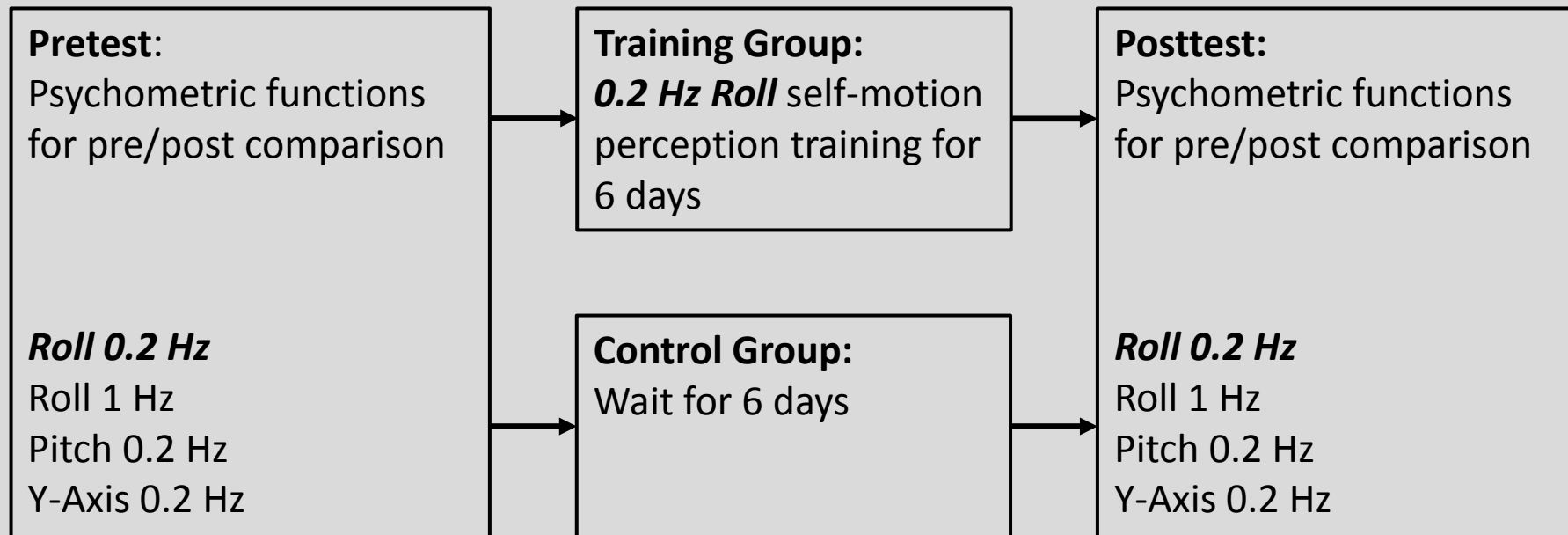
Subjects and Stimuli

- Self-motion perception training
- MOOG 6DOF motion platform
- single-cycles of sinusoidal acceleration motion profiles in the dark
- Subjects:
 - Training group: n = 10
 - Control group: n = 20



Methods

Design



Methods

0.2 Hz Roll Tilt Self-Motion Training

- Training of self-motion direction discrimination task
- One intensity per subject with target accuracy 65%
- 3 blocks per day for 6 days, 100 trials per block
- Feedback was given on error trials

Methods

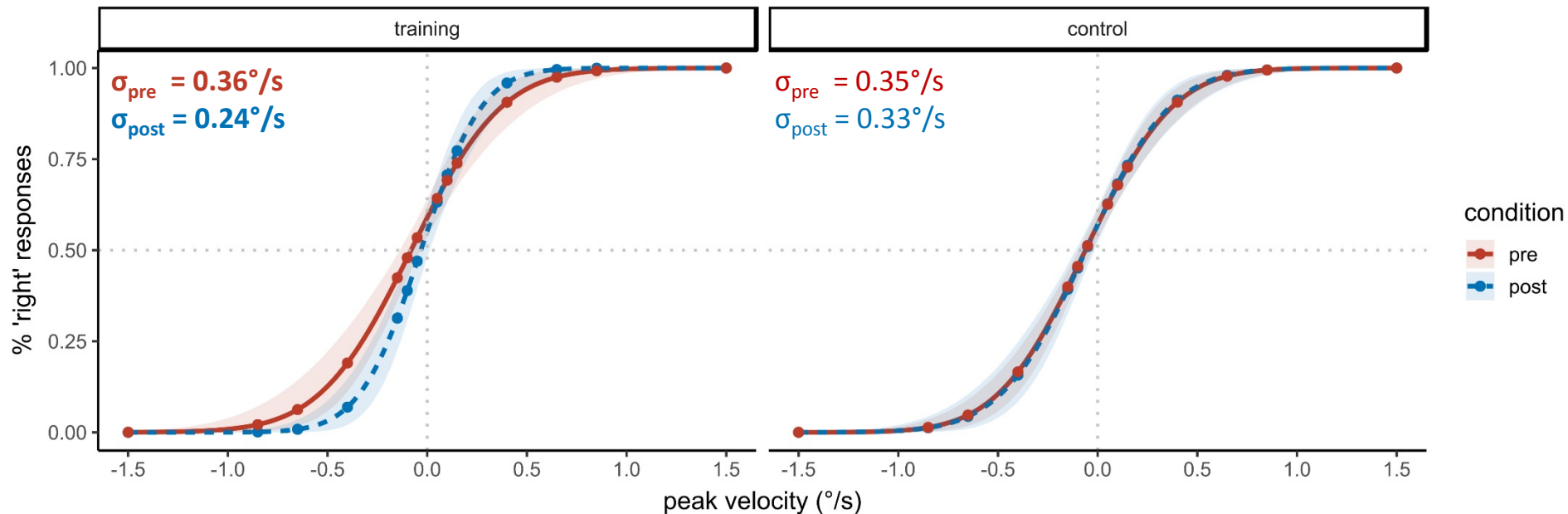
Data Analysis

Hierarchical generalized linear model with probit link function

- **Pre/Post comparison:** $\text{response} \sim \text{velocity} * \text{group} * \text{condition}$
- **Training effect:** $\text{response} \sim \text{direction} * \text{block}$

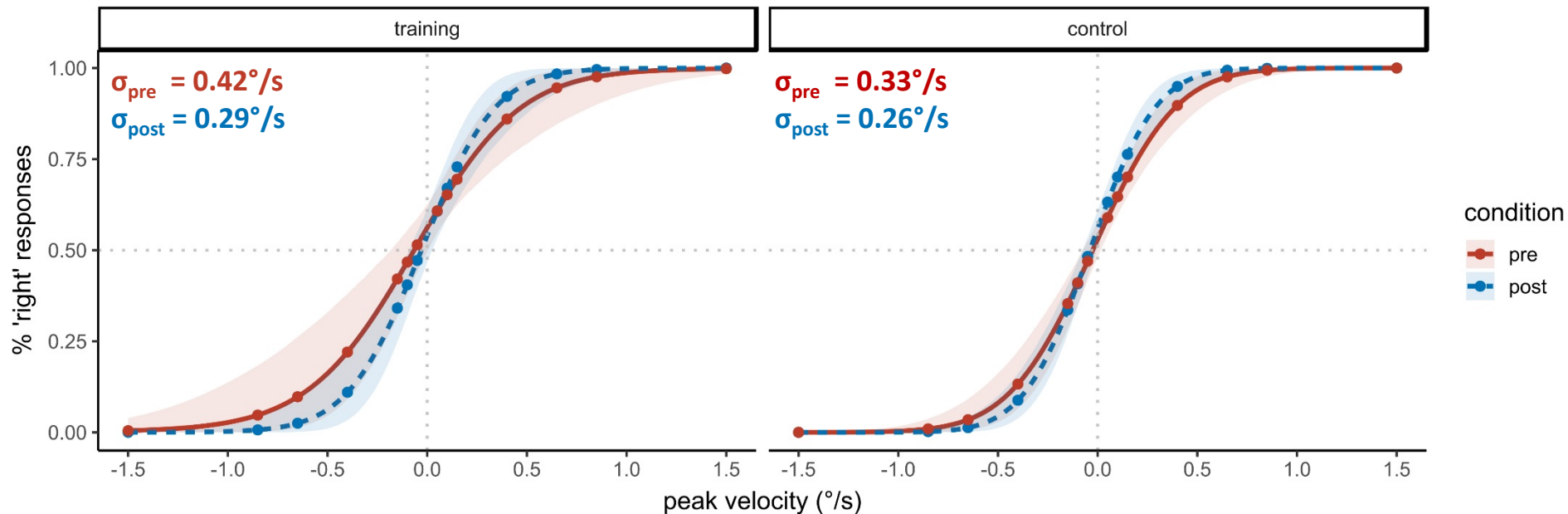
Results

Roll 0.2 Hz



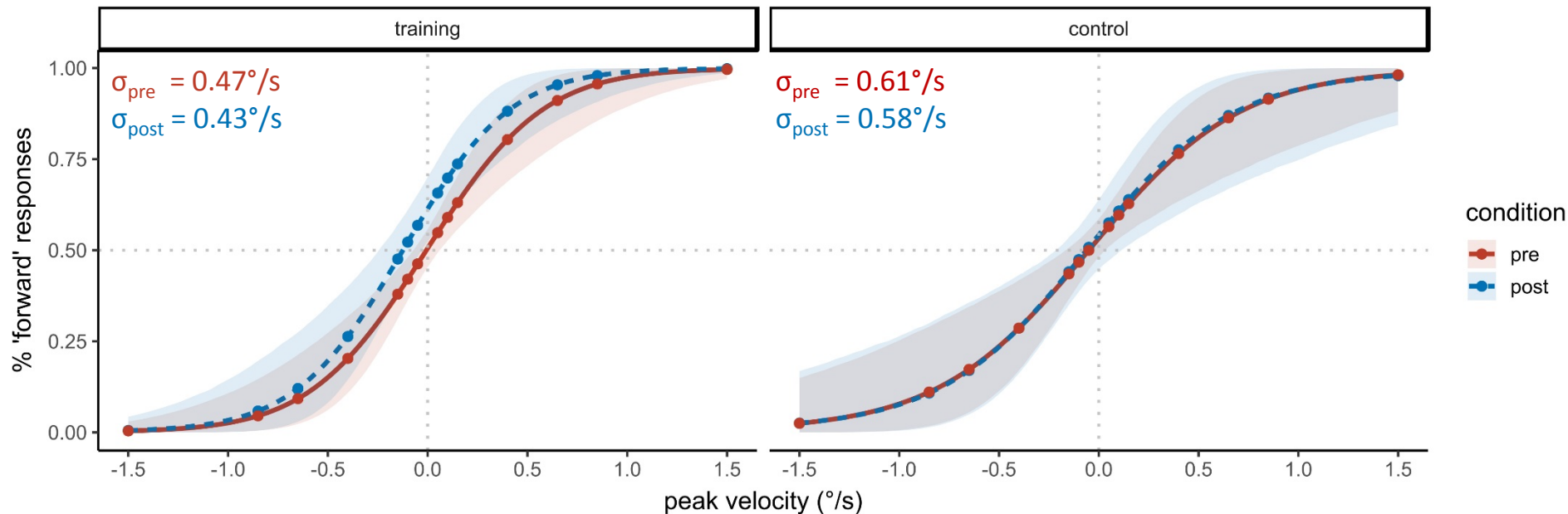
Results

Roll 1 Hz



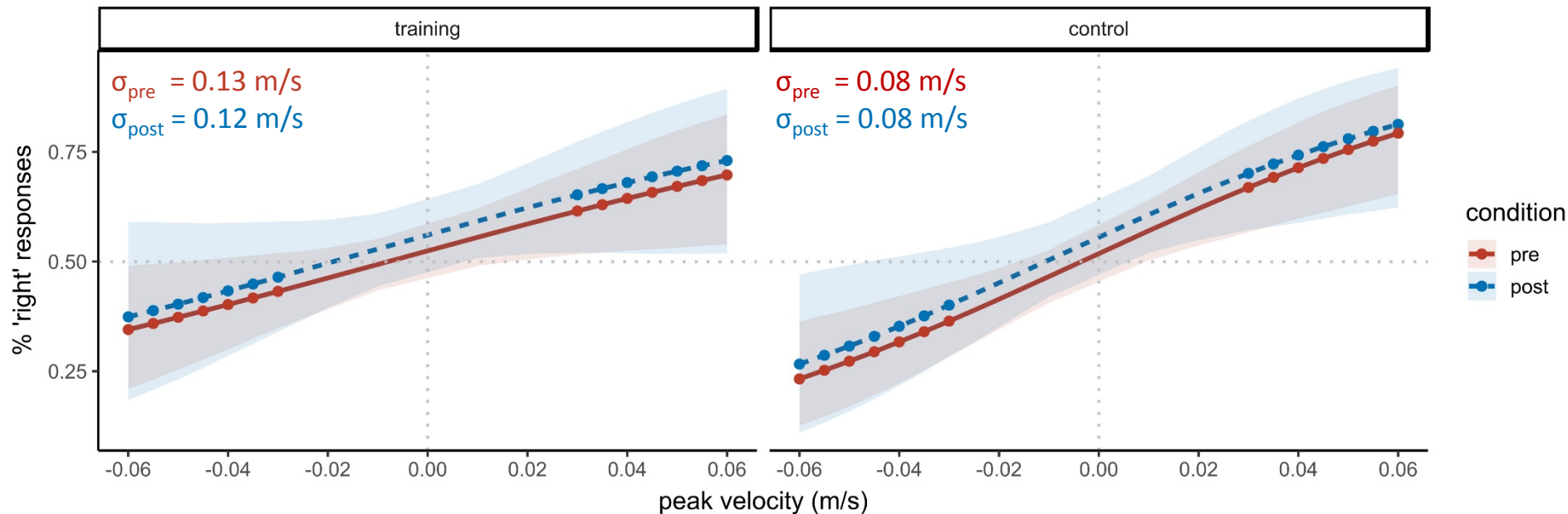
Results

Pitch 0.2 Hz



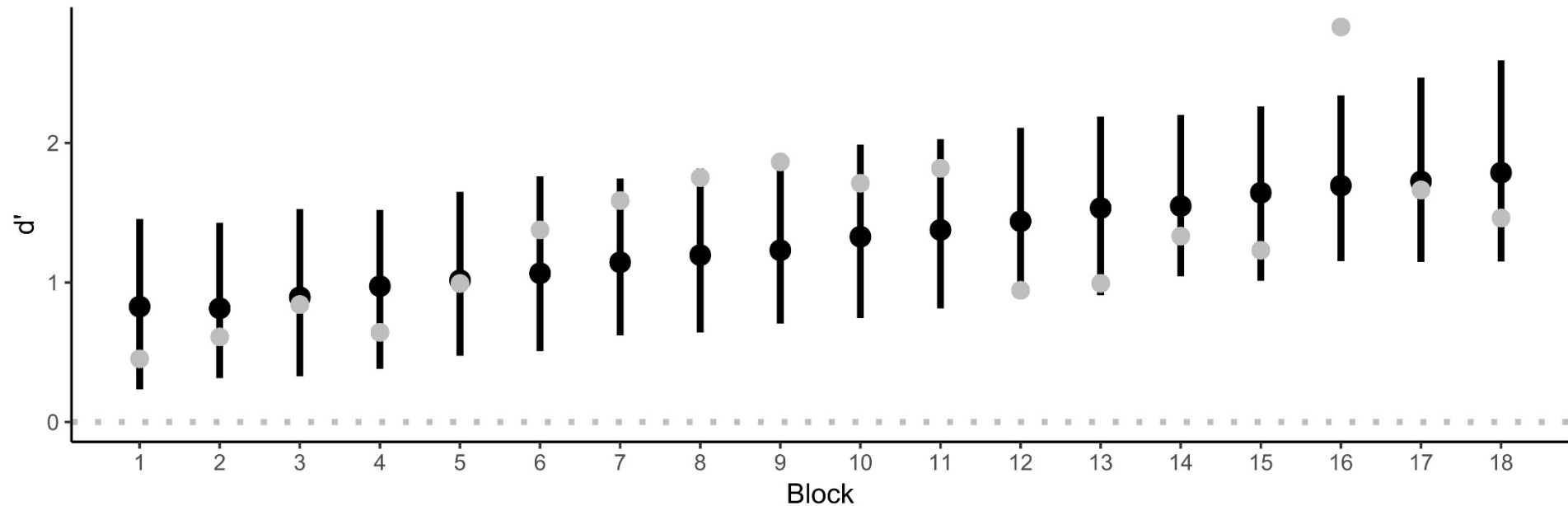
Results

Y-Translation 0.2 Hz



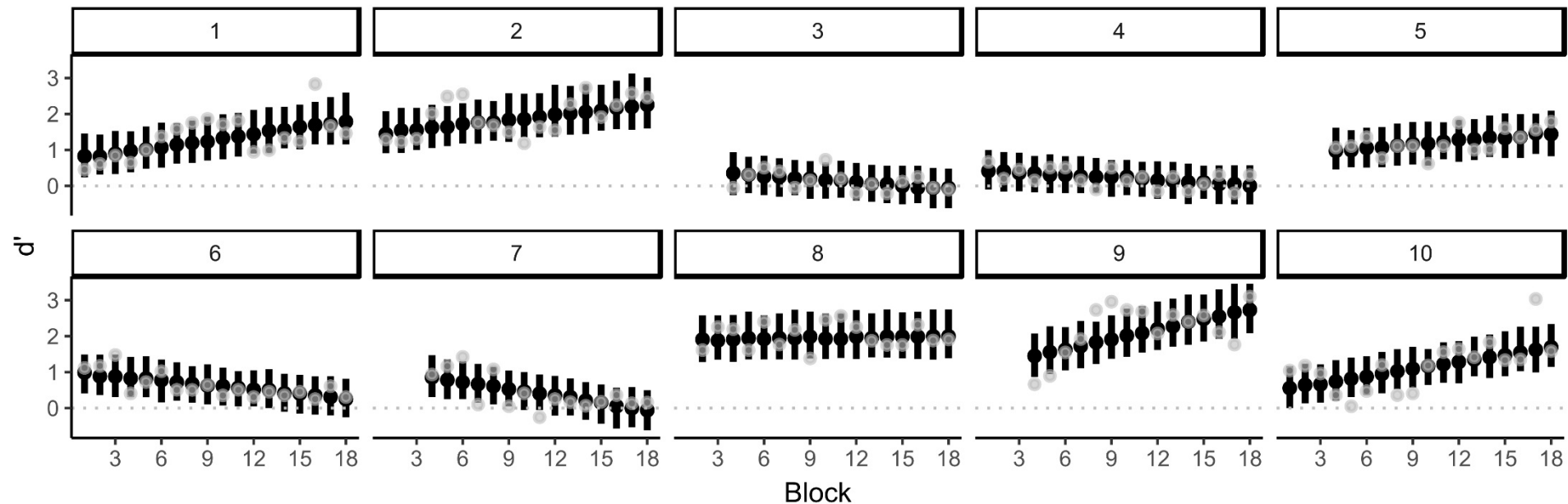
Results

Training Effect: Subject 1



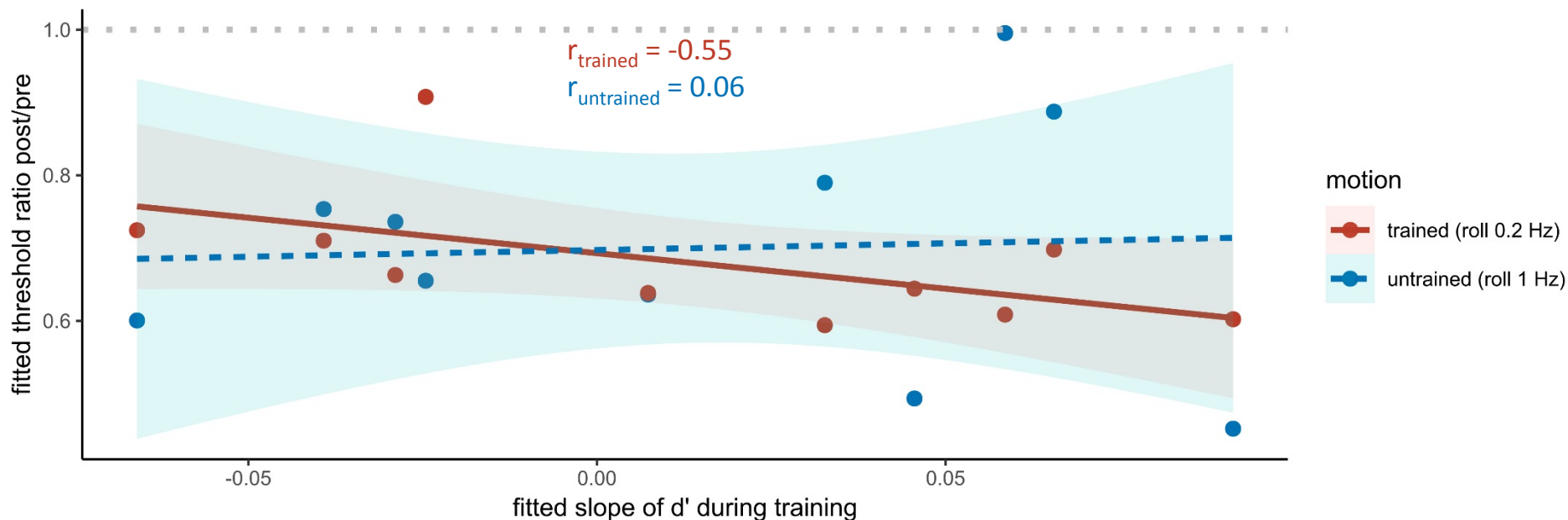
Results

Training Effect



Results

Correlation: Training – Pre/Post Comparison



Discussion

Main Finding

- Perceptual learning of roll tilt self-motion in the dark
- Self-motion threshold was reduced by 33% after 6 days of training
- Training was specific to the trained motion

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Thank you for your attention!